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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/940,642	08/29/2001	Shinichi Kawate	35.C15728	5606

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EXAMINER
PERRY, ANTHONY T

ART UNIT	PAPER NUMBER
2879	

DATE MAILED: 06/27/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/940,642	KAWATE ET AL
	Examiner	**Art Unit**
	Anthony T. Perry	2879

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 May 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-16,20-29,34-37,41 and 43* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-16,20-29,34-37,41 and 43* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *23 August 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *5/20/05*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after allowance or after an Office action under *Ex Parte Quayle*, 25 USPQ 74, 453 O.G. 213 (Comm'r Pat. 1935). Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, prosecution in this application has been reopened pursuant to 37 CFR 1.114. Applicant's submission filed on 5/20/05 has been entered.

Information Disclosure Statement

The information disclosure statement (IDS) submitted on 5/20/05 was filed after the mailing date of the notice of allowance on 3/11/05. The submission is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement has been considered by the examiner.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be firstd by the manner in which the invention was made.

Claims 16, 20-21, 29, 34-35, and 43 are rejected under 35 U.S.C. 103 as being obvious over Takigawa et al. (JP 11-118462).

Regarding claims 16, 29, and 43, Fig. 9 of the Takigawa reference discloses an electron-emitting device comprising a first electrode (902) and a second electrode (903)

formed in opposition to each other with a gap between them on a substrate (901). A plurality of fibers (904) are electrically connected to the first electrode and comprise carbon (see paragraph 0041-0042). The fibers (904) are shown on a top surface of the first electrode (902) in Fig. 9, however Takigawa teaches an alternate arrangement where the fibers are located on the first electrode's surface facing the second electrode instead of its top surface (see paragraph 0042). The fibers are inherently not connected to the second electrode since such an arrangement would cause a short in the electron-emitting device taught by Takigawa rendering it inoperable. Takigawa teaches the electron emitting devices used in FED's (image forming apparatuses that inherently include fluorescent members), and therefor teaches an electron source comprising a plurality of electron-emitting devices arrayed on a substrate.

Takigawa et al. do not specifically state what type of carbon fibers (single graphen, plurality of graphens, etc.) are used. However, various types of carbon fibers suitable for use as emitters, including a plurality of graphens stacked so as not to be parallel to the axis direction of the fibers, are well known in the art of electron-emitting devices. It has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. Thus, it would have been obvious to one having ordinary skills in the art at the time the invention was made to have selected carbon fibers in the form of a plurality of graphens stacked so as not to be parallel to the axis direction of the fibers, since the selection of known materials for a known purpose is within the skill of the art.

Regarding claim 20 and 34, the recitation "wherein electrons are emitted by applying a voltage between said second electrode and said first electrode so that a

potential of said second electrode is higher than that of the first electrode" has not been given patentable weight because it is considered an intended used recitation. It has been held that a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations.

Furthermore, the teachings of the Takigawa reference cover the intended use recitation.

Regarding claim 21 and 35, as stated above, Takigawa teaches fibers located on the side surface of the first electrode (902). The bottom surface of the second electrode is adjacent to the surface of the substrate (901). As such, the height from the surface of the substrate to the fibers is necessarily larger than a height from the surface of substrate to a surface of the second electrode (903).

Claims 1-2, 4-15, 21-27, 36-37, and 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takigawa et al. (JP 11-118462) in view of Den et al. (JP 11-194134).

Regarding claims 1, 13, and 23-24, Fig. 9 of the Takigawa reference discloses an electron-emitting device comprising a first electrode (902) and a second electrode (903) formed in opposition to each other with a gap between them on a substrate (901). A plurality of fibers (904) are electrically connected to the first electrode and comprise carbon (see paragraph 0041-0042). The fibers (904) are shown on a top surface of the first electrode (902) in Fig. 9, however Takigawa teaches an alternate arrangement where

the fibers are located on the first electrode's surface facing the second electrode instead of its top surface (see paragraph 0042). The fibers are inherently not connected to the second electrode since such an arrangement would cause a short in the electron-emitting device taught by Takigawa rendering it inoperable. Takigawa teaches the electron emitting devices used in FED's (image forming apparatuses that inherently include fluorescent members), and therefor teaches an electron source comprising a plurality of electron-emitting devices arrayed on a substrate.

Takigawa et al. do not specifically state what type of carbon fibers (single graphen, plurality of graphens, etc.) are used. However, various types of carbon fibers suitable for use as emitters, including a plurality of graphens stacked so as not to be parallel to the axis direction of the fibers, are well known in the art of electron-emitting devices. It has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. Thus, it would have been obvious to one having ordinary skills in the art at the time the invention was made to have selected carbon fibers in the form of a plurality of graphens stacked so as not to be parallel to the axis direction of the fibers, since the selection of known materials for a known purpose is within the skill of the art.

Takigawa does not specifically state that the fibrous carbon is grown through a catalyst disposed on a first layer of an oxide of Ti, Zr, or Nb. However, Den et al. teach a method using a first layer (22) having a conductive front face of an oxide of Ti (see paragraph 0074) formed on a surface of an electrode (81) between the electrode (81) and the carbon fibers (24). The fibrous carbon (24) is grown from a catalyst particle (23) disposed on a sidewall surface of the first layer (22) facing the side of a second electrode

(82). Den teaches that such an arrangement provides a carbon fiber whose terminus binds to the conductive surface of the layer so that conduction between the surface and the carbon nanotube is maintained. The carbon fibers also have a uniform direction of growth, providing a high performance electron emission device capable of generating a large quantity of electrons.

Accordingly, one of ordinary skill in the art, at the time the invention was made, would have found it obvious to use the method of growing and supporting carbon fibers through an oxide of titanium, as taught by Den, in order to provide highly efficient electron-emitting devices.

Regarding claims 2 and 27, Fig. 8 of the Den reference teaches only the sidewall surface of the first layer (22) facing the side of the second electrode (82) being exposed and the other surfaces thereof covered with a second layer (83) on which fibrous carbon (24) does not grow as compared with said first layer (22).

Reasoning for combination given in the rejection of claims 1, 13, and 23-24, above, applies.

Regarding claim 4, Takigawa et al. teach the fibrous carbon being a carbon nanotube (paragraph 0042).

Regarding claims 5-7, Takigawa does not specify what type of carbon nanotube is used. However, "nanotube" is a generic term used for all types of nanotubes, including a nanotube that comprises a plurality of graphens stacked so as not to be parallel to an axis direction of the fibrous carbon. Various types of carbon fibers suitable for use as emitters, including a plurality of graphens layered in an axis direction of the fiber, are well known in the art of electron-emitting devices. It has been held to be within the

general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. Thus, it would have been obvious to one having ordinary skills in the art at the time the invention was made to have selected carbon fibers in the form of a plurality of graphens layered in the axis direction of the fibers, since the selection of known materials for a known purpose is within the skill of the art.

Reasoning for combination given in the rejection of claims 1, 13, and 23-24, above, applies.

Regarding claims 8 and 25, Den teaches a catalyst particle (23) consisting of Ni (see paragraph 0062).

Reasoning for combination given in the rejection of claims 1, 13, and 23-24, above, applies.

Regarding claims 9 and 21, Takigawa teaches fibers located on the side surface of the first electrode (902). The bottom surface of the second electrode is adjacent to the surface of the substrate (901). As such, the height from the surface of the substrate to the fibers is necessarily larger than a height from the surface of substrate to a surface of the second electrode (903).

Reasoning for combination given in the rejection of claims 1, 13, and 23-24, above, applies.

Regarding claims 10 and 22, Fig. 8 of the Den reference shows the second electrode (82) and the first electrode (81) are formed on a surface of substantially planar shape of the substrate (80) with the thickness of the first electrode (81) being larger than a thickness of the second electrode (82).

Reasoning for combination given in the rejection of claims 1, 13, and 23-24, above, applies.

Regarding claim 11, it is noted that the applicant's specific limitation of the substrate being thicker in a region where the first electrode is formed, does not solve any of the stated problems or yield any unexpected result that is not within the scope of the teachings applied. Den teaches the first electrode being thicker than the second electrode. One of ordinary skill in the art would have found it obvious to have the electrodes of the combined device in such a matter so that the carbon nanotubes are located at a sidewall of the first electrode at a height above the top surface of the second electrode so that the second electrode does not absorb the emitted electrons. It is considered to be a matter of choice, which a person of ordinary skill in the art would have found obvious to select any method of ensuring the height of the carbon nanotubes is greater than the second electrode, including having a thicker cathode electrode, increasing the thickness of the substrate at a position of the first electrode, forming the first electrode on top of an insulating layer, etc..

Reasoning for combination given in the rejection of claims 1, 13, and 23-24, above, applies.

Regarding claim 12, Fig. 8b of the Den reference shows the first layer (22) on the first electrode (81) inside of the gap between the second electrode (82) and the first electrode (81) on a surface of the substrate (80).

Reasoning for combination given in the rejection of claims 1, 13, and 23-24, above, applies.

Regarding claim 14, the Takigawa and Den references do not specifically recite the arrayed electron-emitting devices connected to a matrix-wiring pattern. However, it is well known in the art to array such electron-emitting devices and to electrically connect them through the use of a matrix-wiring pattern so that each of the devices can be selected and driven to operate independently by means of a simple matrix wire arrangement instead of a complex wiring system having separate wires for each device. Accordingly, one of ordinary skill in the art at the time of the invention would have found it obvious to use such a matrix-wiring pattern in order to simplify the wiring step of an electron source.

Rejection of claims 1, 13, and 23-24, above, applies.

Regarding claim 15, Takigawa teaches the electron-emitting device used as the discharge element for an image-forming apparatus (FED) which inherently comprises a fluorescent member. The image-forming member of such an image-forming apparatus for forming an image by collision of emitted electrons is inherently disposed at a position facing the electron source.

Reasoning for combination given in the rejection of claims 1, 13, and 23-24, above, applies.

Regarding claim 26, the Den reference teaches that the first layer is electrically conductive (see paragraph 0074).

Reasoning for combination given in the rejection of claims 1, 13, and 23-24, above, applies.

Regarding claim 36, it is noted that the applicant's specific limitation of the substrate being thicker in a region where the first electrode is formed, does not solve any

of the stated problems or yield any unexpected result that is not within the scope of the teachings applied. Den teaches the first electrode being thicker than the second electrode. One of ordinary skill in the art would have found it obvious to have the electrodes of the combined device in such a matter so that the carbon nanotubes are located at a sidewall of the first electrode at a height above the top surface of the second electrode so that the second electrode does not absorb the emitted electrons. It is considered to be a matter of choice, which a person of ordinary skill in the art would have found obvious to select any method of ensuring the height of the carbon nanotubes is greater than the second electrode, including having a thicker cathode electrode, increasing the thickness of the substrate at a position of the first electrode, forming the first electrode on top of an insulating layer, etc.

Reasoning for combination given in the rejection of claims 1, 13, and 23-24, above, applies.

Regarding claim 37, Fig. 8b of the Den reference teaches a method of growing carbon nanotubes parallel to a substrate. The method uses a first layer (22) having a conductive front face of an oxide of Ti (see paragraph 0074) formed on a surface of an electrode (81) between the electrode (81) and the carbon fibers (24). The fibrous carbon (24) is grown from a catalyst particle (23) disposed on a sidewall surface of the first layer (22) facing the side of a second electrode (82) (see above rejection of claims 1, 16, and 23-24).

Reasoning for combination given in the rejection of claims 1, 13, and 23-24, above, applies.

Regarding claim 41, Fig. 8 of the Den reference teaches only the sidewall surface of the first layer (22) facing the side of the second electrode (82) being exposed and the other surfaces thereof covered with a second layer (83) on which fibrous carbon (24) does not grow as compared with said first layer (22).

Allowable Subject Matter

Claims 3 and 28 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter:

Regarding claims 3 and 28, the prior art does not teach the material covering the first layer being one of Ta, Cr, Au, Ag, Pt, or of the material making up the catalyst particle.

Other Prior Art Cited

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Chen et al. (US 6,471,936) teaches different types of nanotube structures including ones with plural graphens stacked so as not to be parallel to the axis of the nanotube (see for example Figs. 2c-2d); Kikuchi et al. (EP 0,758,028 B1) teaches selective nanotube growth where nanotubes are grown only on side surfaces of a layer of cobalt due to a layer of quartz covering the top surface; and Yoshioka et al. (US 5,066,883) teaches a sidewall emitter.

Response to Arguments

Applicant's arguments, see amendment, filed 1/12/04, with respect to the rejection(s)of claim(s) 1-29 have been fully considered and are persuasive. Therefore, the rejections have been withdrawn. However, upon further consideration, a new ground(s) of rejection has been made.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to *Anthony Perry* whose telephone number is **(571) 272-2459**. The examiner can normally be reached between the hours of 9:00AM to 5:30PM Monday thru Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nimesh Patel, can be reached on (571) 272-24597. **The fax phone number for this Group is (703) 872-9306.**

Communications via Internet e-mail regarding this application, other than those under 35 U.S.C. 132 or which otherwise require a signature, may be used by the applicant and should be addressed to [Anthony.perry@uspto.gov].

All Internet e-mail communications will be made of record in the application file. PTO employees do not engage in Internet communications where there exists a possibility that sensitive information could be identified or exchanged unless the record includes a properly signed express waiver of the confidentiality requirements of 35 U.S.C. 122. This is more clearly set forth in the Interim Internet Usage Policy published in the Official Gazette of the Patent and Trademark on February 25, 1997 at 1195 OG 89.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956.

Anthony Perry
Patent Examiner
Art Unit 2879
June 24, 2005

6/23/05
Mariceli Santiago
Primary Examiner
Art Unit 2879